Minutes of the Meeting With CERN DSF (Divisional Silicon Facility)

Attended: Ian McGill and Alan Honma from DSF, Jan Rak from ALICE, Henri Seppanen Helsinki University, Andrey Sukhanov, BNL.

Comments from DSF

Design.

The fanout design is marginally OK for prototype phase but for production phase the design with pitch adapter is much more preferable. Wire bonding of current current will require extensive attention from the operator, he will need reposition and check the wedge placement almost for every pad.
When the wire bonding pads are very well arranged (parallel wires, large pads) then wire bonding additional 128 wires (due to pitch adapter) is easy.

Solder mask

Less area should be covered with the solder mask in the high-density area. It is impossible to wire bond at the base of the high-density pads. Some pads (at the edges) are half covered.

Assembly

For current assembly we used ARclad 8026 tape for non-conductive bonds and ARclad 9032 tape. The tapes are acceptable for prototyping. For production we need to be sure that the adhesive does not outgases the substances which could be harmful for sensors, I.e chlorine. We have to make sure that the conductivity stays acceptable over the time life of the module.

Flatness issues

The assembly is still not flat, when mounted on the vacuum chuck with suction hole in the center of the board then the sensor-related pads are slightly in the air (about 0.2-0.3mm), this may cause non-reliable wire bonding.

Sensor Stress and Flexible Adhesive.

Nothing is flat in principle. The silicon sensors are not flat, they tend to pop up in the middle, obviously this will be worse for larger sensors. The PCB tends to warp in opposite direction. Even ceramic is not flat. If we force the sensor to be flat using rigid adhesive then it will be stressed and the leakage current can jump to the sky. **We have to use flexible adhesives on both sides of the silicon**. For reliable wire bonding we probably have to provide custom suction under the bonding area. After wire bonding the sensor will play back into a less-stressable shape.

Flatness of the PCB

PCB tends to peel off at the corners. The PCB plays when pressed. The adhesive seems to be too soft. In current module Mike have applied two (maybe even three) layers of the transfer tape ARclad 8026, this was done to compensate the thickness of the foil which runs across the sensor and has thickness of 50um + 25um of adhesive. The things will improve if we modify the ceramic cover to make it with

notches where the foil will be attached. In that case the adhesive deposition will be thin and uniform.

The flatness of the PCB become much worse after stuffing.

PCB Quality

The pads are bondable but their surface is too rough. They probably used some kind of brush polishing. On narrow pads the bonding wire may sits only on 2-3 bumps and it can be easily pulled off. The bonding strength is probably OK for prototype but for production it need to be better. For Example the CMS required that 80% bond should pass the pull-up test at 8 gram.

The DSF requires that all PCBs will be sent to them for bondability tests before they go into modules.

Sensor Quality

Why they have so small bonding pads?

The surface quality is bad (as usual for ELMA's sensors). They rank sensor providers like this:

1) Hamamatsu of course, 2) BARC, India (but their sensors often have excessive leakage current), 3)Taiwan, 4)ELMA.

The bonding and pull-up tests on the existing sensors was acceptable. Ian suggest anyway to apply 3 bonds per pad in that zone.

Transfer Cases

It is important to prepare transfer cases for transportation and storage of the modules. They do not need to be fancy expensive boxes. The anti-static box with module secured using a kapton scotch tape is good enough for storage as well as for in-person transportation. For cargo transportation the module has to be attached on a soft anti-static padding.

Test Wire Bonding

The main conclusion: the wire bonding of 70 boards is doable but not easy. The height of the highest wire relative to PCB surface is 650um which within our limit of 900um.

DSF Availability

In general they think that they can wire bond 70 modules, but this will require longer time as it will be mainly manual process.

They are involved in two more prioritized projects (TOTEM and some another one).

The ALICE upgrade will have next priority.

They request to fill in a job requirement sheet and to define the time frame.

Proposed Schedule

1) First priority – order 2 PCBs(connector adapter and SpRC adapter), needed for connecting the readout card to FEM for testing.
2) Order (minimum 70) of ceramic substrates with notches.
3) After my return on Thursday Mike should make two more modules.
4) Wire bond the bus and control SVX lines on these modules.
5) When adapter PCB arrives we can test the functionality of the readout cards.
6) If test is successful – make wire bonding of SVX4 to readout card
7) Test the pedestals
8) Wire bond readout card to sensor.
9) Test for pedestals, and if possible test with beta source.
10) If tests are successful, then we can define job requirements and time frame for CERN
11) Initiate assembly and wire bonding of 12 modules at BNL.
12) I hope all this could be done in 3 weeks from now.
13) The rest depends on DSF response.